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[MARKED-UP COPY OF THE SPECIFICATION]

Method for producing a heterogeneous, in particular multicolored, sheet-like structure, mold and sheet-like structure

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Cross Reference to Related Applications

[0001] The present invention claims priority as a national stage application of International Patent Application Serial No. PCT/EP 05/012623 filed on November 25, 2005; and German Patent Application Serial No. DE 102004059066.4 filed on December 7, 2004, which are both hereby incorporated herein by reference in their entirety.

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DescriptionBackground

[0002] The invention relates to a method for producing a heterogeneous, in particular multicolored, sheet-like structure, for example a decorative skin for an interior trim part of a vehicle, and to molds suitable for this purpose and to sheet-like structures produced thereby.

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Prior art

[0003] Patent application DE 102 11 663 A1 discloses a method for producing a heterogeneous, but one-piece, molded part, which consists in certain regions of a hard, thermoplastic material, for example polypropylene (PP) or a PP compound, and an elastically deformable material, for example an olefin-based thermoplastic

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elastomer. The first and second segments of the molded part are produced in separate molds and subsequently joined to form a unit by molding on a connecting segment.

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**[0004]** This method is suitable for producing small molded parts of complex geometry and high-value appearance, but is less suitable for producing large, sheet-like structural members, in particular decorative skins for interior trim parts, on account of the awkward handling of the extended segments of the structural member.

#### **ProblemSummary**

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**[0005]** The invention is based on the problem of providing a method for producing high-value and heterogeneous, in particular at least two-colored, sheet-like structures.

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#### **Solution**

**[0006]** The problem is solved according to the invention in the case of this method by at least a first cavity and a second cavity of a mold being filled with at least a first and a second polymer material which are free-flowing and after removal form a one-piece sheet-like structure, a sealing element being arranged in the mold, at least during the filling of one cavity, and extends along the parting plane in relation to the neighboring cavity.

**[0007]** The sealing element achieves the effect of reliable segmentation of the surface of the one-piece molded skin in the case of an extended and possibly complexly shaped longitudinal extent of the parting

plane. In particular in the case of multicolored sheet-like structures, a distinct separation is created between the adjacent, differently colored surface regions, so that the molded skin is suitable for use in 5 particularly demanding application areas of automobile construction.

[0008] A suitable mold for carrying out the method has |  
10 at least a first mold part and a second mold part, which can be displaced with respect to said first part, which mold parts form at least a first cavity and a neighboring second cavity, which can be filled with at least a first and a second free-flowing polymer material, after the closing of the mold. According to 15 the invention, a sealing element is arranged along the parting plane between the first cavity and the second cavity.

[0009] The following developments of the method can be |  
20 used with particular advantage when reactively curing polymer materials are used, injected into the cavities by means of an injection-molding process (Reaction Injection Molding (RIM)). These polymers have a particularly low viscosity in the free-flowing state, 25 so that the sealing between the cavities assumes special significance.

[0010] According to a first embodiment of the method |  
according to the invention, the sealing element is 30 firmly connected to one mold part, in particular the upper mold, and can be pressed against another mold part, in particular the lower mold. The sealing element is preferably expandable under fluid pressure ("inflatable seal") and can be pressed against a 35 protruding projection of the other mold part, in particular the lower mold.

15 [0011] After the filling of the first cavity with the first polymer material, the sealing element can be lifted off the other mold part and the second cavity filled with the second polymer material, the first and second polymer materials bonding with each other in such a way that they fuse together but appear distinctly separate. The lifting off of the seal preferably takes place by reducing the fluid pressure inside the tube-like seal, it also being possible to set a fluid pressure that lies below the ambient pressure. This creates a lifting-off force which exceeds the elastic recovery of the sealing element.

20 15 [0012] In the case of a mold that can be used here, the sealing element is preferably firmly arranged in one mold part, in particular the upper mold, and can be pressed against the other mold part, in particular the lower mold, in an expandable manner under fluid pressure.

25 [0013] According to another embodiment of the invention, before the filling of the cavities, the sealing element is loosely placed into one mold part, in particular the upper mold, in the region of the parting plane, and, during the closing of the mold, is made to bear in a sealing manner against the other mold part, in particular the lower mold.

30 30 [0014] The sealing element can advantageously be pressed against a protruding projection of the other mold part, in particular the lower mold, and, during the filling of the cavities, bonds with the first polymer material on the one hand and the second polymer material on the other hand in such a way that they fuse together. The sealing element is therefore lost in the

production of the molded skin and must be replaced by a new sealing element before renewed filling of the cavities.

5 [0015] In the case of a suitable mold, the sealing element can be loosely placed into one mold part, in particular the upper mold, and can be pressed against the other mold part, in particular the lower mold.

10 **Brief Description of the Figures**

[0016] The figures present various embodiments of the invention schematically and by way of example.

15 [0017] Figures 1a-e show how a first method according to the invention is carried out using a first mold suitable for this purpose,

20 [0018] Figures 2a-e shows a mold and a method according to another development of the invention.

**Detailed Description of the Preferred and Exemplary Embodiments**

25 [0019] The mold 1 shown in Figures 1a to 1d comprises a first mold part 2 in the form of the upper mold 3 and a lower mold 4, forming a second mold part 2'. The upper mold 3 and the lower mold 4 can be displaced in relation to each other and, in their position for use 30 as shown in Figure 1a, form a first cavity 5 and a second cavity 5'. The cavities, extending in a two-dimensional manner, can be filled with different free-flowing polymer materials by means of injection-molding units (not shown) and are suitable for the production 35 of sheet-like structures which have a very small thickness in relation to their length and width. The

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cavities do not have to be formed in a planar manner, but may also have a curved profile for the production of complexly shaped decorative skins.

5    [0020] The upper mold 3 is provided along the parting plane 6 between the neighboring cavities 5, 5' with a tubular sealing element 7, the hollow space 8 of which can be filled with a compressed gas after the closing of the mold parts 2, 2'. The sealing element 7 is  
10 firmly connected to the mold upper part 3 by means of a securing means 10, which can be fixed by screws 9. As a result of the positive pressure, the sealing element 7, the longitudinal extent of which may likewise have a complex profile, expands elastically and comes to lie  
15 in a sealing manner against a projection 11 protruding from the lower mold 4. Subsequently, as can be seen from Figure 1b, the first cavity 5 is filled with a low-viscosity first polymer material 12, which is gray for example, is prevented by the sealing element 7 from  
20 passing over into the second cavity 5' and cures in the first cavity 5 as the result of a chemical reaction.

[0021] Subsequently, the hollow space 8 of the sealing element 7 is subjected to negative pressure, so that  
25 the sealing element 7 lifts off from the projection 11 (Figure 1c). The second polymer material 12', which is subsequently injected into the second cavity 5' and is black for example, penetrates as far as the first polymer material 12 and bonds with it during the  
30 reactive curing in such a way that they fuse together. After the opening of the mold 1 (Figure 1f), the two-colored sheet-like structure 13 obtained in this way can be removed.

35    [0022] The mold as shown in Figure 2a, intended for carrying out another method according to the invention,

likewise has two mold parts 2, 2' in the form of an upper mold 3 and a lower mold 4, the lower mold 4 likewise being provided with a projection 11. On its side facing the projection 11, the upper mold is 5 provided with a groove-like receptacle 14 for the clamping, but releasable, securement of an elastic sealing element 7 in the form of a strand (Figure 2b).

100231 After the closing of the mold 1 (Figure 2c), 10 the two cavities 5, 5', neighboring but separated by the sealing element, are filled with differently colored, free-flowing polymer materials 12, 12', which penetrate as far as the sealing element and bond with the latter in such a way that they fuse together 15 (Figure 2d).

100241 As shown in Figure 2e, after the curing of the polymer materials 12, 12' and the opening of the mold 1, the one-piece sheet-like structure 13 including the 20 lost sealing element 7 can be removed. Apart from the colors of the first and second polymer materials 12, 12', the sheet-like structure 13 may of course have another color, determined by the sealing element 7, in the region of the parting plane 6.

**Designations**

- 1 mold
- 2 mold part
- 3 upper mold
- 4 lower mold
- 5 cavity
- 6 parting plane
- 7 sealing element
- 8 hollow space
- 9 screw
- 10 securing means
- 11 projection
- 12 polymer material
- 13 sheet-like structure
- 14 receptacle

**Patent claims**

1. A method for producing a heterogeneous, in particular multicolored, sheet-like structure (13),  
5 for example a decorative skin for an interior trim part of a vehicle, in which at least a first cavity (5) and a second cavity (5') of a mold (1) are filled with at least a first and a second polymer material (12, 12') which are free-flowing and after  
10 removal from a one-piece sheet-like structure, a sealing element (7) being arranged in the mold, at least during the filling of one cavity, and extends along the parting plane in relation to the neighboring cavity.  
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2. The method as claimed in claim 1, characterized in that the sealing element (7) is firmly connected to one mold part (2), in particular the upper mold (3), and can be pressed against another mold part (2'), in particular the lower mold (4).  
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3. The method as claimed in claim 2, characterized in that the sealing element (7) is expandable under fluid pressure.  
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4. The method as claimed in claim 2 or 3, characterized in that the sealing element (7) can be pressed against a protruding projection (11) of the other mold part (2'), in particular the lower mold (4).  
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5. The method as claimed in one of claims 2 to 4, characterized in that, after the filling of the first cavity (5), the sealing element (7) is lifted off the other mold part (2') and the second cavity (5') is subsequently filled, the first and second  
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polymer materials (12, 12') bonding with each other in such a way that they fuse together.

6. The method as claimed in claim 1, characterized in that, before the filling of the cavities (5, 5'), the sealing element (7) is loosely placed into one mold part (2), in particular the upper mold (3), in the region of the parting plane (6), and, after the closing of the mold (1), is made to bear in a sealing manner against the other mold part (2'), in particular the lower mold (4).  
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7. The method as claimed in claim 6, characterized in that the sealing element (7) can be pressed against a protruding projection (11) of the other mold part (2'), in particular the lower mold (4).  
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8. The method as claimed in claim 6 or 7, characterized in that, during the filling of the cavities (5, 5'), the sealing element (7) bonds with the first polymer material (12) on the one hand and the second polymer material (12') on the other hand in such a way that they fuse together.  
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9. The method as claimed in one of the preceding claims, characterized in that the cavities are filled by means of an injection-molding process with reactively curing polymer materials (RIM technology).  
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10. A mold for carrying out the method as claimed in claim 1, with at least a first mold part (2) and a second mold part (2'), which can be displaced with respect to said first part, which mold parts form at least a first cavity (5) and a neighboring second cavity (5'), which can be filled with at least a first and a second free-flowing polymer  
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material (12, 12'), after the closing of the mold, characterized in that a sealing element (7) is arranged along the parting plane (6) between the first cavity (5) and the second cavity (5').

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11. The mold as claimed in claim 10 for carrying out the method as claimed in claims 2 to 5, characterized in that the sealing element (7) is firmly arranged in one mold part (2), in particular the upper mold (3), and can be pressed against the other mold part (2'), in particular the lower mold (4), in an expandable manner under fluid pressure.
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12. The mold as claimed in claim 10 for carrying and the method as claimed in claims 6 to 8, characterized in that the sealing element (7) can be loosely placed into one mold part (2), in particular the upper mold (3), and can be pressed against the other mold part (2'), in particular the lower mold (4).
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13. A sheet-like structure, produced using the method as claimed in one of claims 2 to 5 and/or the mold as claimed in claim 11.
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- 25
14. A sheet-like structure, produced using the method as claimed in one of claims 6 to 8 and/or the mold as claimed in claim 12.

## **Abstract**

In the case of a method for producing a heterogeneous, in particular multicolored, sheet-like structure (13), for example a decorative skin for an interior trim part of a vehicle, at least a first cavity (5) and a second cavity (5') of a mold (1) are filled with at least a first and a second polymer material (12, 12') which are free-flowing and after removal form a one-piece sheet-like structure. At least during the filling of one cavity, a sealing element (7) is arranged in the mold (1) and extends along the parting plane (6) in relation to the neighboring cavity.

{Fig 1e}